

2MBI600XDE120-50

IGBT Modules

Power Module (X series)
1200V / 600A / 2-in-1 package

■ Features

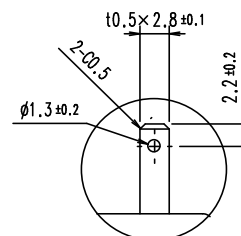
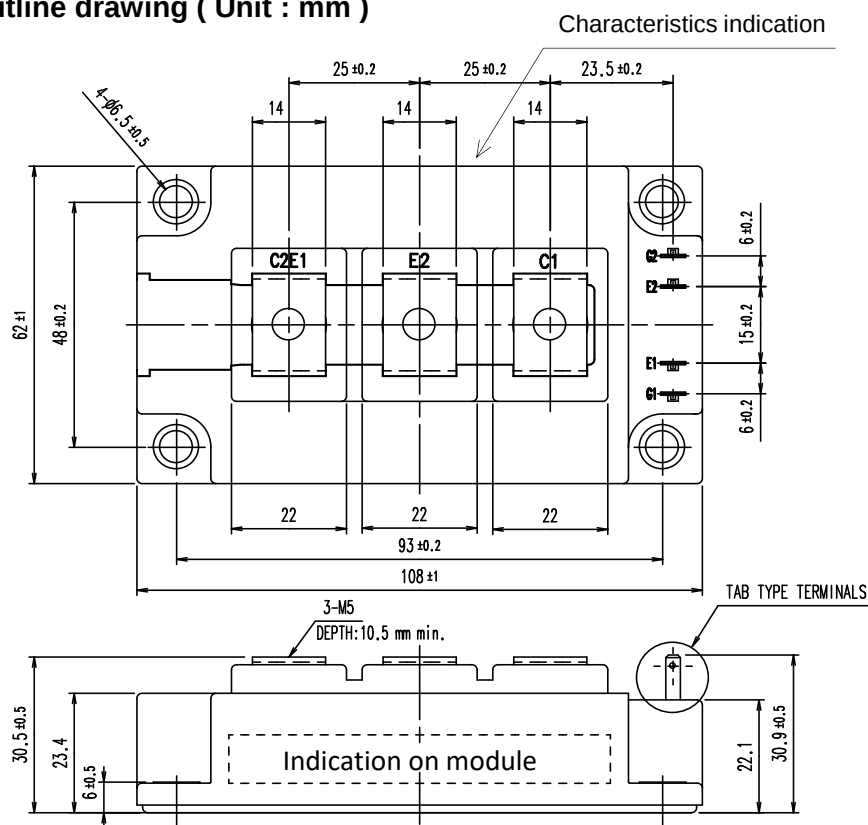
- LOW $V_{CE(sat)}$
- High speed switching
- Low Inductance Module structure

■ Applications

- Inverter for Motor Drives, AC and DC Servo Drives
- Uninterruptible Power Supply Systems,
- Industrial machines, such as Welding machines



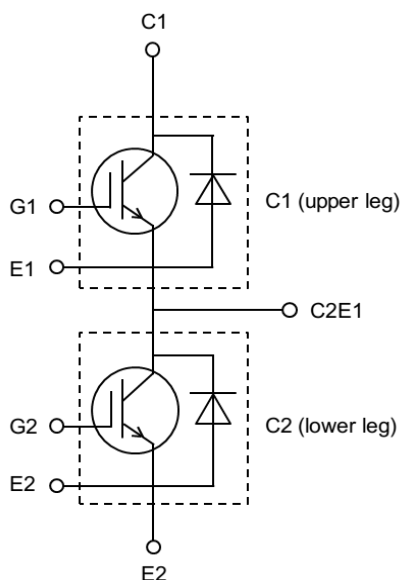
■ Outline drawing (Unit : mm)



DETAIL TAB TYPE TERMINALS

Weight: 370g(typ.)

■ Equivalent Circuit



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■ Absolute Maximum Ratings (at $T_c = 25^\circ\text{C}$ unless otherwise specified)

Items		Symbols	Conditions	Maximum Ratings	Units
Collector-Emitter voltage, Gate-Emitter short-circuited		V_{CES}		1200	V
Gate-Emitter voltage, Collector-Emitter short-circuited		V_{GES}		± 20	V
Collector current		I_C	Continuous $T_c = 100^\circ\text{C}$	600	A
Repetitive peak collector current		I_{CRM}	1ms	1200	
Forward current		I_F		600	
Repetitive peak forward current		I_{FRM}	1ms	1200	
Total power dissipation		P_{tot}	1 device	3655	W
Virtual Junction temperature		T_{vj}		175	$^\circ\text{C}$
Operating virtual junction temperature		T_{vjop}		175	
Case temperature		T_c		125	
Storage temperature		T_{stg}		-40 ~ 125	
Isolation voltage	between terminal and copper base (*1)	V_{isol}	AC: 1min.	4000	Vrms
Mounting torque of screws to heat sink(*2)		M_s	M5 or M6	6.0	N m
Mounting torque of screws to terminals(*2)		M_t	M6	5.0	

(*1) All terminals should be connected together during the test.

(*2) Recommendable Value: Mounting 3.0 ~ 6.0 N·m (M5 or M6)
Recommendable Value: Terminals 2.5 ~ 5.0 N·m (M6)

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■ Electrical characteristics (at $T_{vj}=25^{\circ}\text{C}$ unless otherwise specified)

Items	Symbols	Conditions		Characteristics			Units
				min.	typ.	max.	
Collector-Emitter cut -off current, Gate-Emitter short - circuited	I_{CES}	$V_{GE} = 0V$ $V_{CE} = 1200V$		-	-	200	μA
Gate leakage current, Collector-Emitter short-circuited	I_{GES}	$V_{CE}=0V, V_{GE}=\pm 20V$		-	-	400	nA
Gate-Emitter threshold voltage	$V_{GE(th)}$	$V_{CE} = 20V$ $I_C = 600mA$		6.0	6.5	7.0	V
Collector-Emitter saturation voltage	$V_{CE(sat)}$ (terminal)	$V_{GE} = 15V$ $I_C = 600A$	$T_{vj}=25^{\circ}C$	-	1.70	2.15	V
	$V_{CE(sat)}$ (chip)		$T_{vj}=25^{\circ}C$	-	1.45	1.90	
			$T_{vj}=125^{\circ}C$	-	1.85	-	
			$T_{vj}=150^{\circ}C$	-	1.90	-	
			$T_{vj}=175^{\circ}C$	-	2.00	-	
Internal gate resistance	r_g	-		-	1.63	-	Ω
Input capacitance	C_{ies}	$V_{CE}=10V, V_{GE}=0V, f=1MHz$		-	63	-	nF
Output capacitance	C_{oes}			-	2.1	-	
Reverse transfer capacitance	C_{res}			-	0.56	-	
Gate charge	Q_G	$V_{CC} = 600V, I_C = 600A$ $V_{GE} = -15 \rightarrow +15V$		-	4000	-	nC
Forward voltage	V_F (terminal)	$V_{GE} = 0V$ $I_F = 600A$	$T_{vj}=25^{\circ}C$	-	1.85	2.30	V
	V_F (chip)		$T_{vj}= 25^{\circ}C$	-	1.60	2.05	
			$T_{vj}=125^{\circ}C$	-	1.70	-	
			$T_{vj}=150^{\circ}C$	-	1.65	-	
			$T_{vj}=175^{\circ}C$	-	1.60	-	
Turn-on delay time (*1)	$t_{d(on)}$	$V_{CC} = 600V$ $I_C, I_F = 600A$ $V_{GE} = +15/ -15V$ $R_G = 0.56 \Omega$ $L_S = 30 \text{ nH}$	$T_{vj}= 25^{\circ}C$	-	400	-	ns
		$T_{vj}=125^{\circ}C$	-	410	-		
		$T_{vj}=150^{\circ}C$	-	415	-		
		$T_{vj}=175^{\circ}C$	-	420	-		
Rise time (*1)	t_r	$T_{vj}= 25^{\circ}C$	-	95	-		
		$T_{vj}=125^{\circ}C$	-	100	-		
		$T_{vj}=150^{\circ}C$	-	100	-		
		$T_{vj}=175^{\circ}C$	-	105	-		
Turn-off delay time (*1)	$t_{d(off)}$	$T_{vj}= 25^{\circ}C$	-	370	-		
		$T_{vj}=125^{\circ}C$	-	405	-		
		$T_{vj}=150^{\circ}C$	-	415	-		
		$T_{vj}=175^{\circ}C$	-	420	-		
Fall time (*1)	t_f	$T_{vj}= 25^{\circ}C$	-	105	-		
		$T_{vj}=125^{\circ}C$	-	170	-		
		$T_{vj}=150^{\circ}C$	-	185	-		
		$T_{vj}=175^{\circ}C$	-	210	-		
Reverse recovery time	t_{rr}	$T_{vj}= 25^{\circ}C$	-	295	-		
		$T_{vj}=125^{\circ}C$	-	285	-		
		$T_{vj}=150^{\circ}C$	-	590	-		
		$T_{vj}=175^{\circ}C$	-	635	-		

(*1) Turn on time (t_{on}) = $t_{d(on)} + t_r$, Turn off time (t_{off}) = $t_{d(off)} + t_f$

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Electrical characteristics (at T_{vj} = 25°C unless otherwise specified)

Items	Symbols	Conditions		Characteristics			Units
				min.	typ.	max.	
Turn-on energy	E_{on}	$V_{CC} = 600V$ $I_C, I_F = 600A$ $V_{GE} = +15/ -15V$ $R_G = 0.56 \Omega$ $L_S = 30 \text{ nH}$	$T_{vj}= 25^{\circ}C$	-	30.0	-	mJ
			$T_{vj}=125^{\circ}C$	-	48.7	-	
			$T_{vj}=150^{\circ}C$	-	53.4	-	
			$T_{vj}=175^{\circ}C$	-	59.7	-	
Turn-off energy	E_{off}		$T_{vj}= 25^{\circ}C$	-	38.7	-	
			$T_{vj}=125^{\circ}C$	-	50.5	-	
			$T_{vj}=150^{\circ}C$	-	53.5	-	
			$T_{vj}=175^{\circ}C$	-	55.3	-	
Reverse recovery energy	E_{rr}		$T_{vj}= 25^{\circ}C$	-	15.8	-	
			$T_{vj}=125^{\circ}C$	-	28.2	-	
			$T_{vj}=150^{\circ}C$	-	31.3	-	
			$T_{vj}=175^{\circ}C$	-	34.3	-	

NOTICE:
The external gate resistance (R_G) shown above is one of our recommended value for the purpose of minimum switching loss. However the optimum R_G depends on circuit configuration and/or environment. We recommend that the R_G has to be carefully chosen based on consideration if IGBT module matches design criteria, for example, switching loss, EMC/EMI, spike voltage, surge current and no unexpected oscillation and so on.

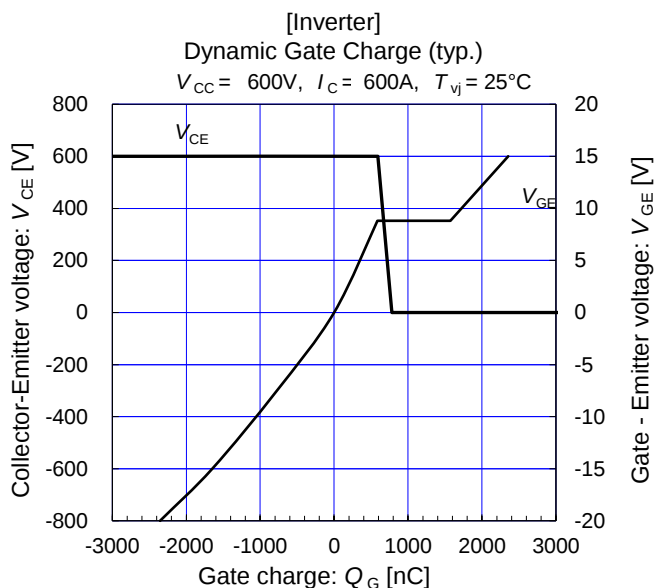
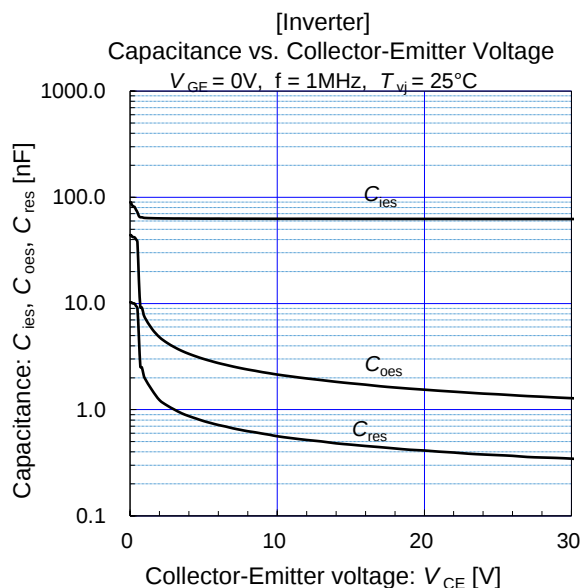
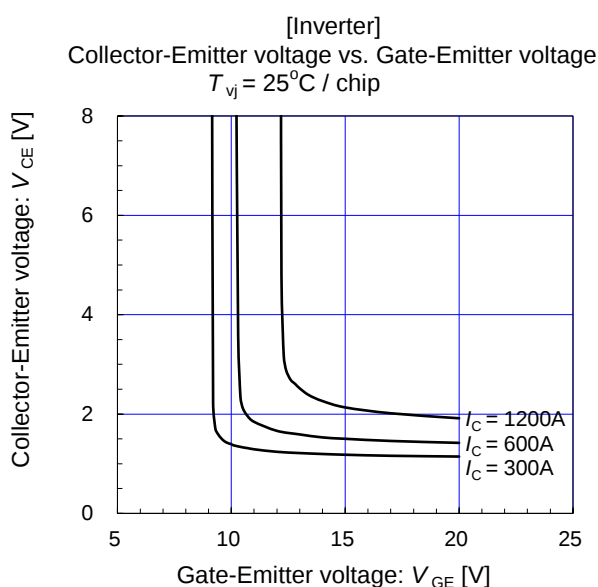
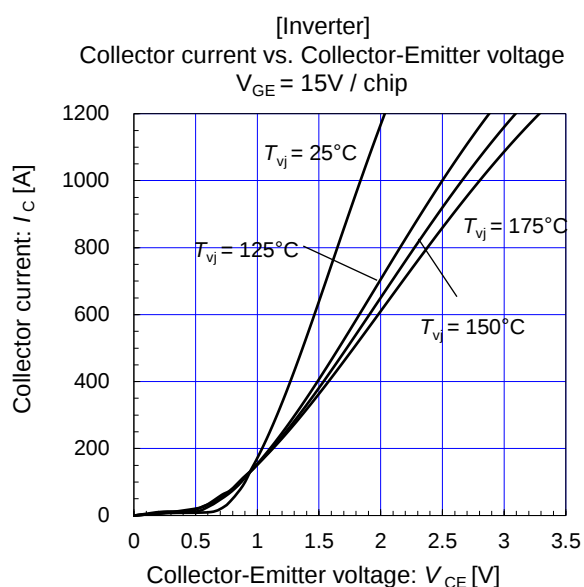
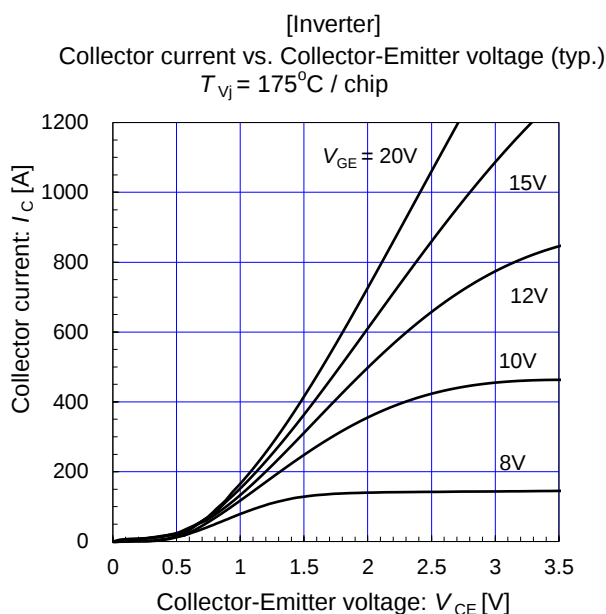
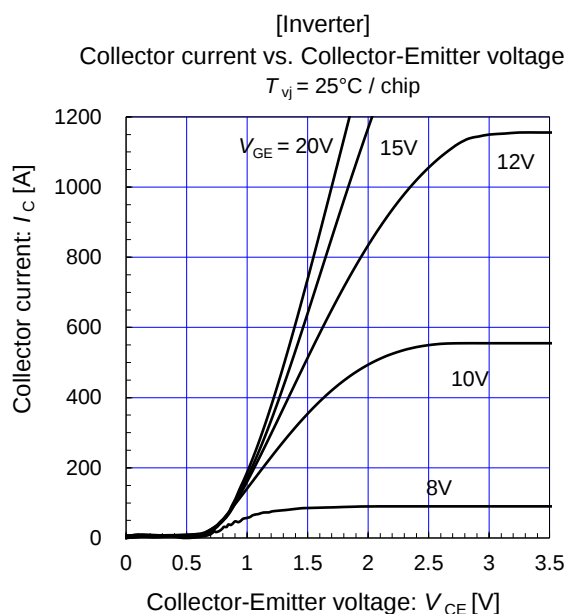
Thermal resistance characteristics

	Symbols	Conditions	Characteristics			Units
			min.	typ.	max.	
Thermal resistance (1device)	$R_{th(j-c)}$	Inverter IGBT	-	-	0.041	K/W
		Inverter FWD	-	-	0.056	
Thermal resistance case to heat sink (1IGBT + 1FWD) (*1)	$R_{th(c-s)}$	with 1 W/(m·K) thermal grease	-	0.0125	-	

(*1) This is the value which is defined mounting on the additional heat sink with thermal grease.

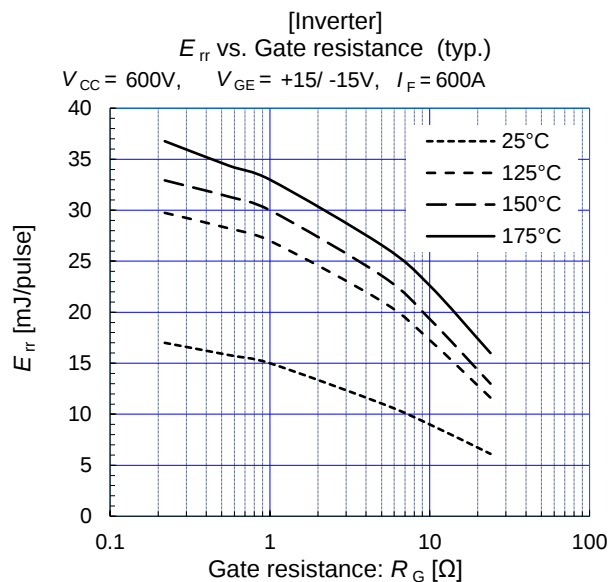
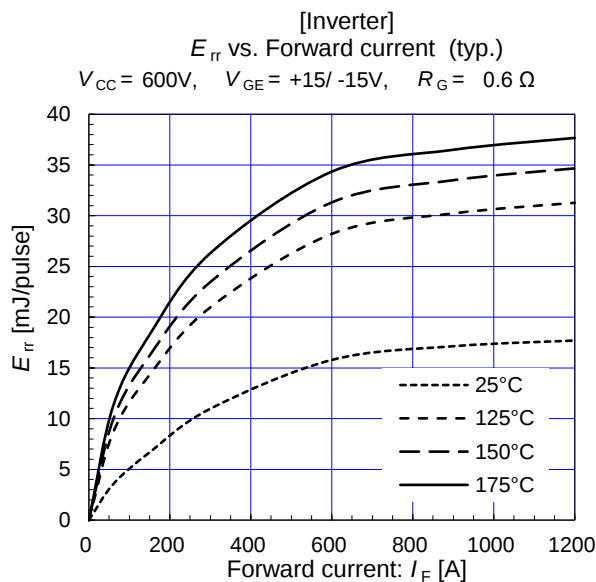
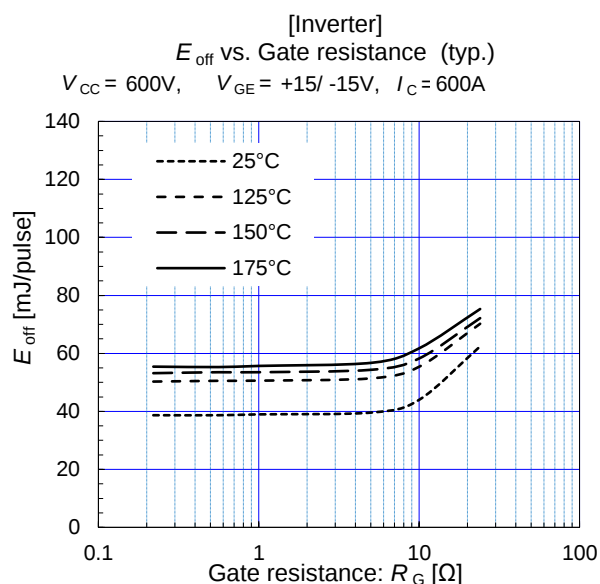
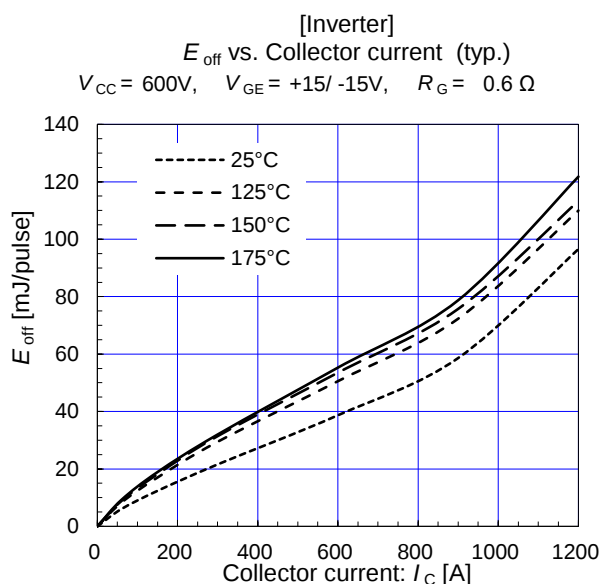
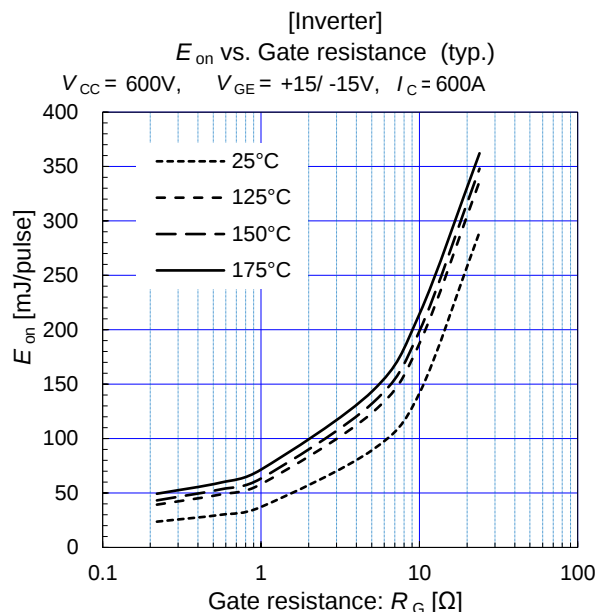
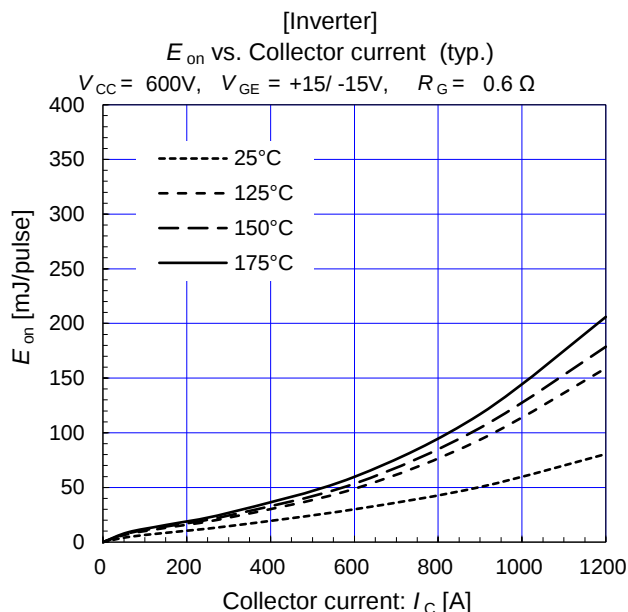
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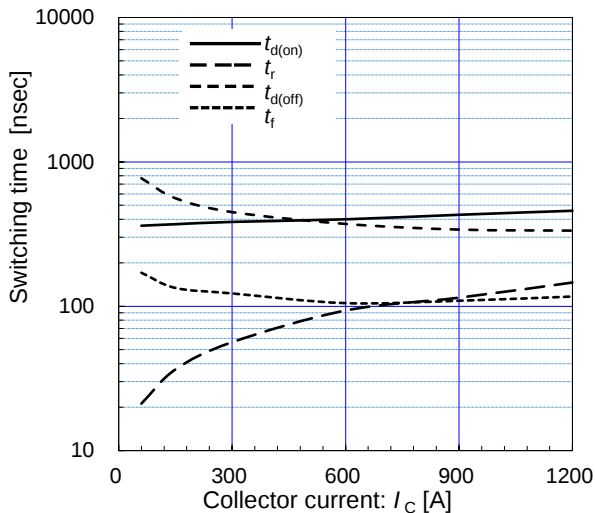
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[Inverter]

Switching time vs. Collector current (typ.)

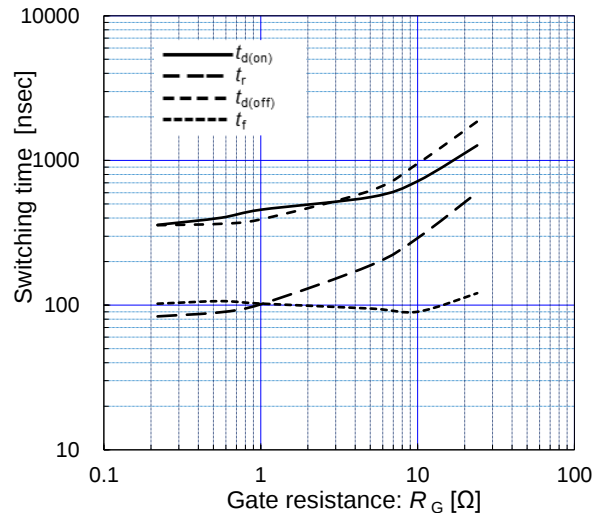
$V_{CC} = 600V$, $R_G = 0.56\ \Omega$, $V_{GE} = +15/-15V$, $T_{vj} = 25^\circ C$



[Inverter]

Switching time vs. Gate resistance (typ.)

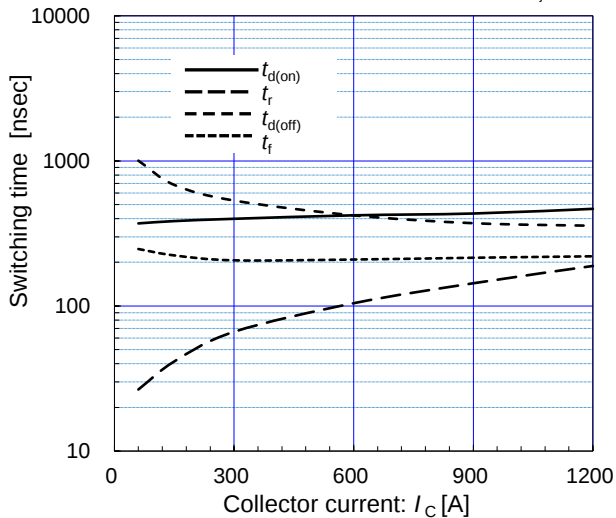
$V_{CC} = 600V$, $I_C = 600A$, $V_{GE} = +15/-15V$, $T_{vj} = 25^\circ C$



[Inverter]

Switching time vs. Collector current (typ.)

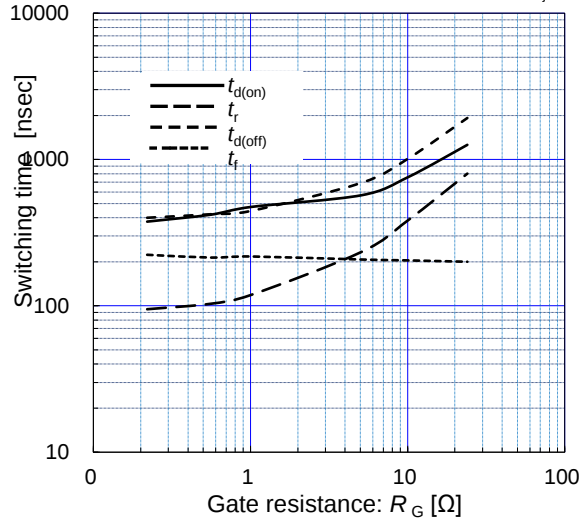
$V_{CC} = 600V$, $R_G = 0.56\ \Omega$, $V_{GE} = +15/-15V$, $T_{vj} = 175^\circ C$



[Inverter]

Switching time vs. Gate resistance (typ.)

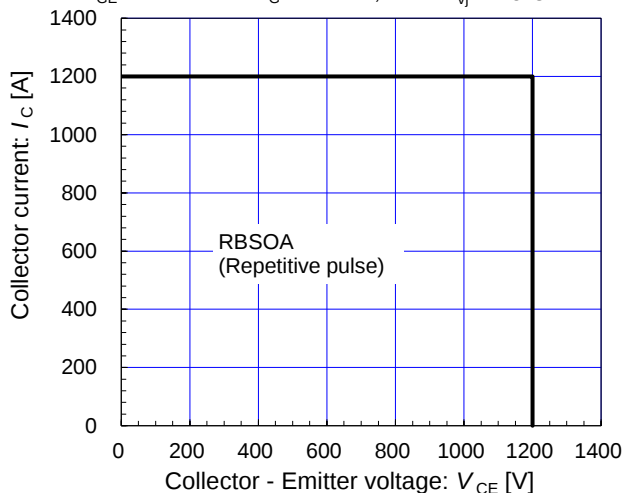
$V_{CC} = 600V$, $I_C = 600A$, $V_{GE} = +15/-15V$, $T_{vj} = 175^\circ C$



[Inverter]

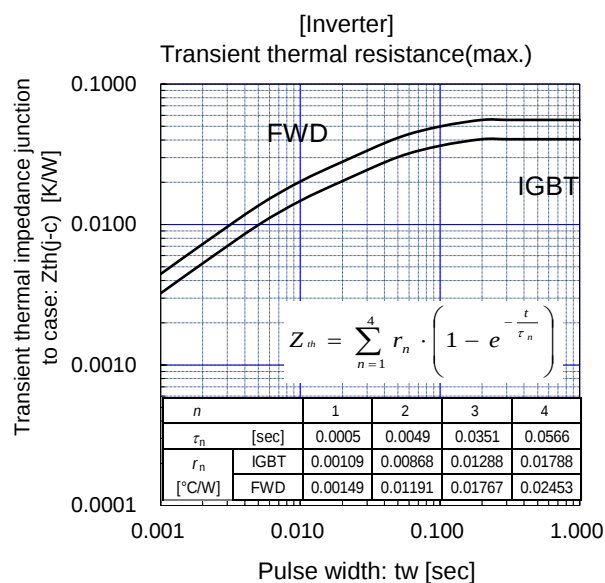
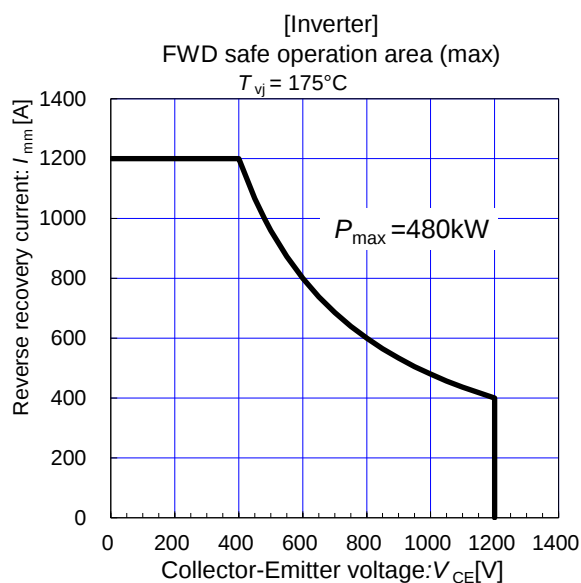
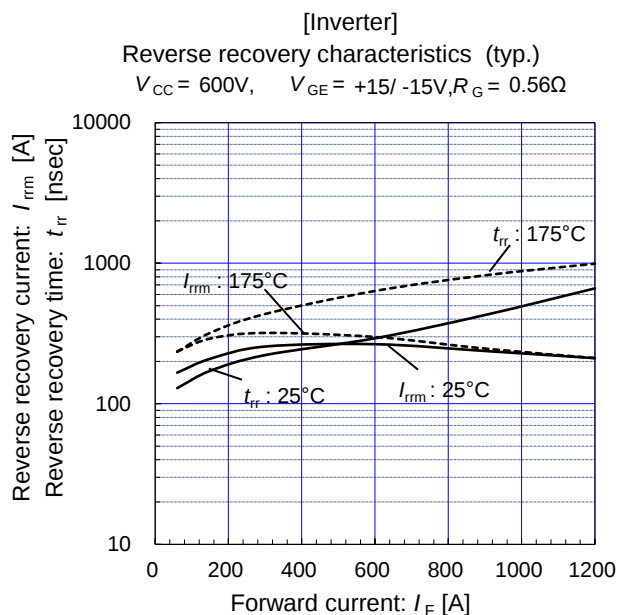
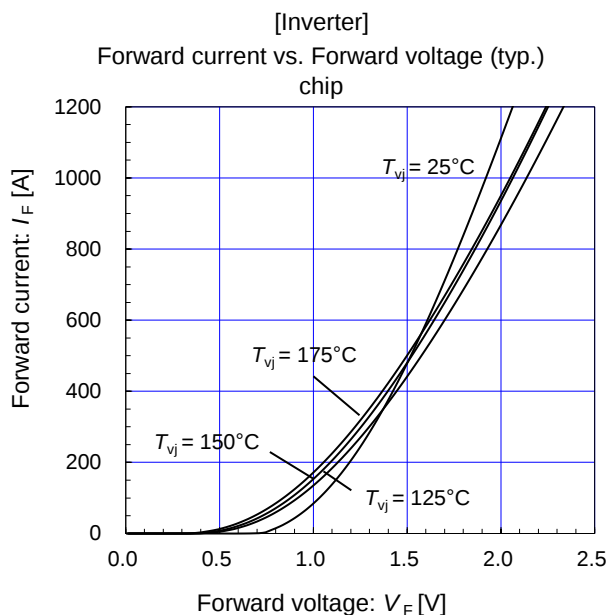
Reverse bias safe operating area (max.)

$V_{GE} = +15/-15V$, $R_G = 0.56\ \Omega$, $T_{vj} = 175^\circ C$



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